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Block I Phase 2 Very Long Baseline Interferometry Implementation

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This article is a status report on the implementation of the Block I VLBI System.

I. Introduction

The Block I VLBI System (Ref. 1) is presently being implemented in the Deep Space Network as a phased implementation. The Block I Phase 1 VLBI System has been previously reported (Ref. 2). Phase 2 of the Block I VLBI System implementation has been completed and is now operational.

II. DSS Configuration

The DSS configuration for Block I Phase 2 is shown in Fig. 1 and remains unchanged from the Block I Phase 1 configuration. Planned changes in the near future to the DSS configuration include:

(1) The replacement of the digital magnetic tape Real-Time Record by a large capacity disc serving the same function. This change obviates the requirement for the many tape changes during the VLBI passes. The disk will be large enough to handle a complete pass.

(2) The inclusion of a digital tone extractor function to the DSS VLBI Subsystem. This addition will permit real-time verification of the presence of the phase calibration tones through the DSS VLBI System.

III. Ground Communication Facility and Network Operations and Control Center Configuration

The GCF-NOCC configuration for Block I Phase 2 is shown in Fig. 2. The Ground Communications Facility has undergone changes in configuration (Ref. 3). The significance of the changes in GCF to the Block I VLBI System lies in the direct connection of the wideband data lines from the wideband data terminals to the recently installed Block I VLBI Processor Subsystem. This change allows the VLBI data to be routed directly from the DSSs to the VLBI Processor Assembly, where the data are recorded on large-capacity (600 Mbyte) discs. The creation of numerous IDRs and the attendant handling of such is thus made unnecessary.

The Network Operations and Control Center configuration was changed by the addition of the Block I VLBI Processor Subsystem. The incorporation of the Block I VLBI Processor Subsystem (VPS), which consists of the VLBI Processor Assembly, the VLBI Correlator Assembly and accompanying software, removes from the Block I VLBI System the Interim VLBI Processor Subsystem. The Interim VLBI Processor consisted of a correlation program on a large general-purpose computer (IBM 360-75). This configuration required the

generation of numerous IDRs in order to transfer the VLBI data to the processor along with the necessity of waiting sometimes many days for the processing to be completed. The addition of the dedicated Block I VLBI Processor Subsystem allowed the processing to be completed in a matter of hours after the receipt of the VLBI data from the participating DSSs.

IV. Correlation and Postcorrelation with the Addition of the VPS

The correlation of the VLBI data is now carried out on the VLBI processor with hardware and software well-documented and transferred to Operations. The postcorrelation effort is carried out on the same processor. However, the software involved is considered Research and Development in nature at the present time. An effort is underway to document and transfer the postcorrelation software to Operations at a later date.

V. Operation Training

DSS operations have been going quite well, with the VLBI passes being scheduled and carried out almost weekly for the past year and a half. The operational proficiency seems to indicate that the training packages were very adequate. The training for the VLBI Processor Subsystem was carried out in a much more informal manner than the DSS training, since there were fewer personnel involved. The training consisted of theory of operation discussion and "hands on" operations with the Development and Operations personnel involved. The operation is currently completely carried out by the Operations personnel.

VI. System Testing

System testing was accomplished by operating the Block I VLBI Processor Subsystem and the interim processor in parallel. This was accomplished by creating IDRs of the same VLBI data that was being obtained by the VPS and then processing the data through both the VPS and the interim processor and verifying that the results were identical in every step of the processing. This test was repeated during several VLBI passes. In every case the processing was verified as identical.

VII. Summary

The Block I Phase 2 VLBI System is operating to support the navigation requirements of the Voyager Project. The System will provide the information related to station clock synchronization, UT1 and polar motion in a timely manner.

References

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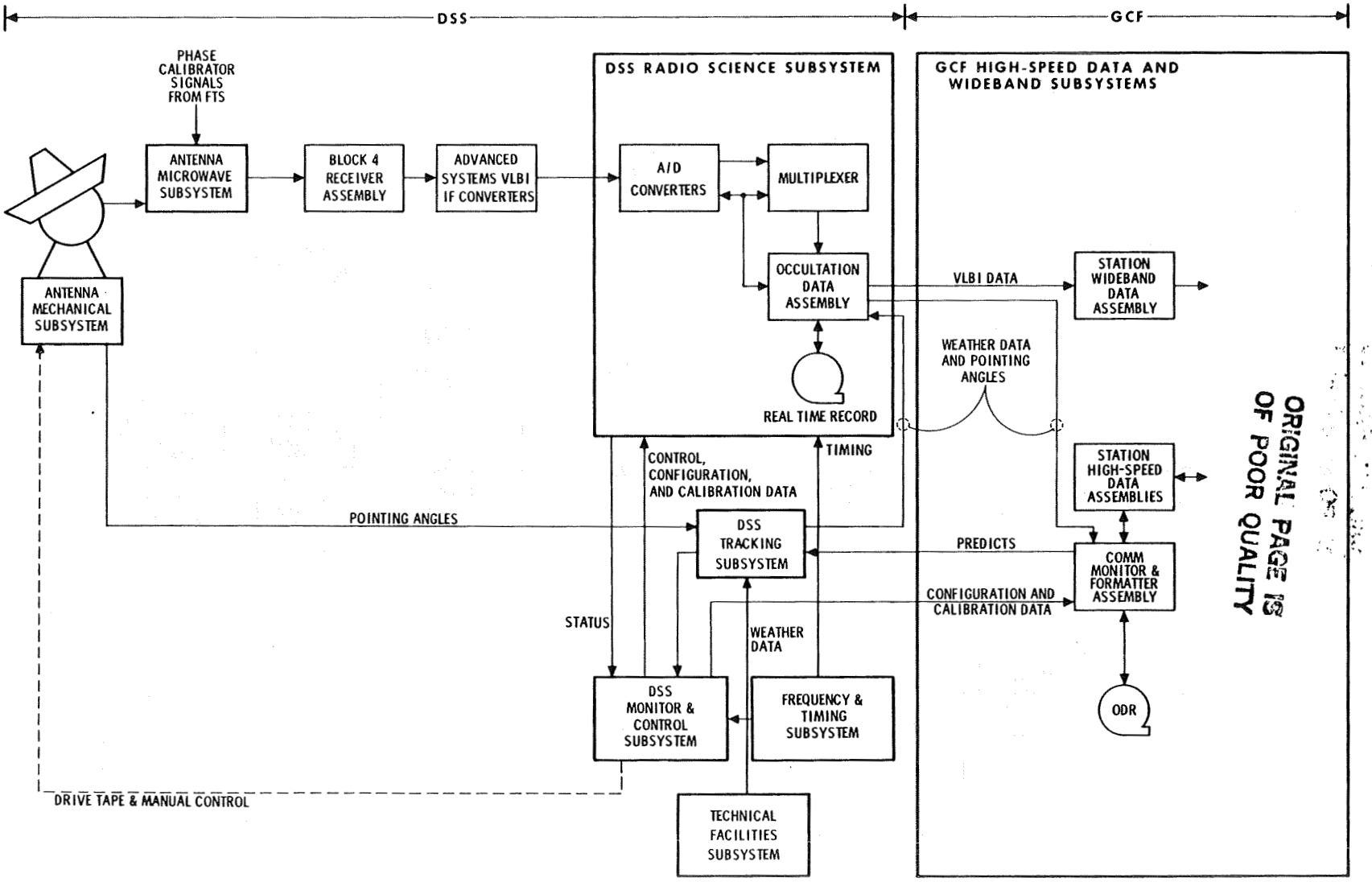

Fig. 1. Deep Space Station block diagram, Block I Phase 2

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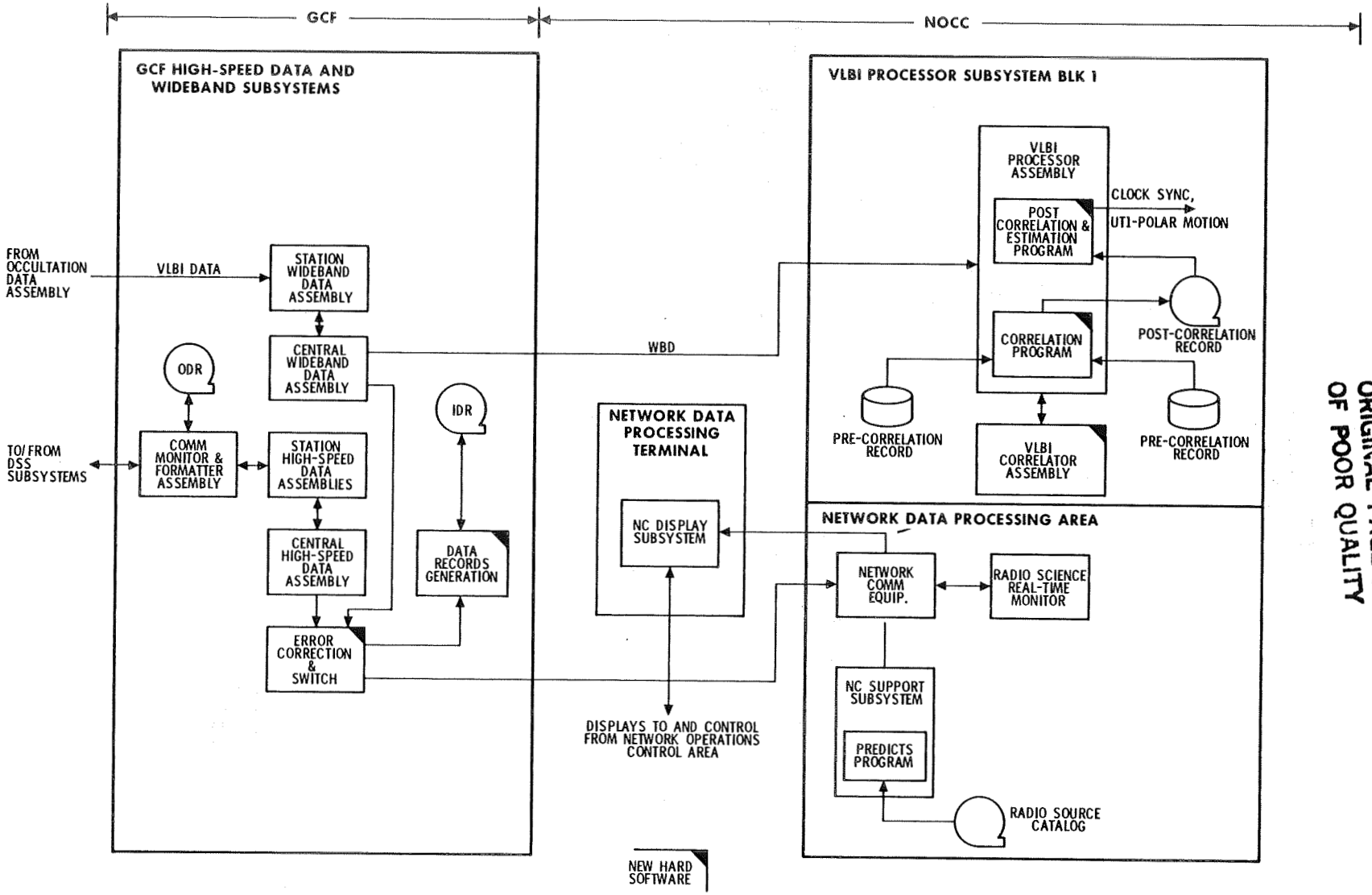

Fig. 2. GCF-NOCC block diagram, Block I Phase 2

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